[Document Name] Description

[Title of the Invention] Solid state image sensing device

[Claim(s)]

[Claim 1] The light perceived according to the electrical change of the detection node which detects the signal electric charge obtained with the photo diode by photoelectric conversion is arranged in the shape of a procession by the cell read as electric information, and it [said detection node] In the solid state image sensing device which is connected to the drain wire which supplies reset voltage through a reset transistor at the time of reset, and it comes to connect with a reset control line with a common gate terminal of said reset transistor of the same line The transistor which carries out connection control of the vertical scanning circuit which carries out flow control of said reset transistor, and said reset control line, and separates said reset control line of a non-choosing line from said vertical scanning circuit at the time of reset of the cell of a selection line, The solid state image sensing device characterized by having the coupling capacity which is connected between said reset control line and said drain wire, and sets said reset control line of a non-choosing line as potential lower than the potential of said drain wire at the time of reset of said cell of a selection line.

[Claim 2] A separation transistor is inserted between said coupling capacity and said reset control line. The solid state image sensing device according to claim 1 which separates said

reset control line and said coupling capacity of a selection line with said separation transistor at the time of the drive of said reset transistor of the selection line by said vertical scanning circuit, and is characterized by things.

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the solid state image sensing device which has improved pouring discharge operation used as the reset action of the cell which reads a signal in source follower form.

[0002]

[Description of the Prior Art] The composition of the solid state image sensing device equipped with the Amplification MOS type cell is shown in drawing 3. In drawing 3, the cell in which a solid state image sensing device performs photoelectrical change of incidence light is arranged in the shape of a procession. [a cell equipped with a photo diode 1, the transfer transistor 2 of an N channel, the reset transistor 3 of an N channel, the detection node 4, the amplification transistor 5 of an N channel, and the selection transistor 6 of an N channel] The signal electron accumulated in the photo diode 1 according to incident light quantity is read to the detection node 4 through the transfer transistor 2. When a gate terminal carries out flow control of the drain wire 7 and the perpendicular signal line 8 common to a cell of the direction of a sequence through the amplification transistor 5 and the selection transistor 6 which were connected to the detection node 3, the electrical change of the detection node 4 is read to the perpendicular signal line 8. The signal read to the perpendicular signal line 8 is read outside from each cell through the level read-out circuit 9 and the output amplifier 10.

[0003] In such composition, also after the signal electron accumulated in the photo diode 1 is read, in the photo diode 1, a little signal electrons still remain. In such the state, the signal electron which remained even if light did not enter into this photo diode 1 on the occasion of

the next signal read-out will be read. When the number of residual signal electrons increases in about one photo diode with many the cell into which a strong light entered especially, i.e., the accumulated signal electron, and an image pick-up result is displayed on a screen, also after the light of a bright part goes out, it will look slightly brightly by a residual signal electron, and a residual image phenomenon will arise.

[0004] In order to prevent such a residual image phenomenon, the reset action called pouring discharge is performed. This is the method of once pouring a lot of electrons into a photo diode 1, after reading a signal electron from a photo diode 1, and discharging an electron from a photo diode 1 after that. The Reason a residual image phenomenon is prevented by performing such pouring discharge operation is because the information on the amount of signals in read-out of the last signal electron of a photo diode 1 is eliminated by pouring discharge. Namely, since all the photo diodes 1 are reset by the residual signal electron same each time by performing pouring discharge operation for every read-out of all the photo diodes 1 A clear picture without the influence of a residual signal electron can be obtained by deducting the fixed signal corresponding to the number of residual signal electrons from the signal read from the photo diode 1.

[0005] Next, in the composition shown in drawing 3, concrete operation of the pouring discharge which avoids the above-mentioned residual image phenomenon is explained with reference to the timing of operation shown in drawing 4.

[0006] First, as shown in drawing 4 after reading a signal electron from the photo diode 1 of a selection line Give a transmission signal to the transfer transistor 2 and a transfer transistor is made into switch-on. A reset signal is given to the reset transistor 3 through the reset control line 12 from the vertical scanning circuit 11, the reset transistor 3 is made into switch-on, and the drain wire 7 is driven from high level to a low level by the drain drive circuit 13. Thereby, a lot of electrons to a low level are poured into the photo diode 1 of a selection line. Next, the drain wire 7 is driven high-level from a low level. Thereby, the electron poured into the photo diode 1 of the selection line is discharged by the drain wire 7. Whenever these operation reads a signal electron from a photo diode 1, it is performed. On the other hand, with the photo diode 1 of a non-choosing line, the transfer transistor 2 and the reset transistor 3 of the cell are made into non-switch-on, and the electron by pouring discharge operation must be made not to be poured in in the photo diode 1 of the non-choosing line before a signal electron is read.

[0007] In such pouring discharge operation, when the drain wire 7 is made into a low level, in order for the reset transistor 3 of a non-choosing cell to be in non-switch-on completely, it is necessary to set up the threshold of the reset transistor 3 highly. However, when the threshold of the reset transistor 3 is made high, the potential of the detection node 4 after discharging the electron poured into the photo diode 1 in pouring discharge operation to the drain wire 7 will become low. If the potential of the detection node 4 is low, the voltage margin for reading a signal from a cell will become small. It was difficult for this to create a solid state image sensing device amplification MOS type [about 3.3V or not more than it] low [supply voltage].

[0008] There is a method of giving potential higher than the high rank supply voltage given to the drain wire 7 as high-level to the gate terminal of the reset transistor 3 as one measure which avoids such fault. For that, the booster circuit for generating potential higher than high rank supply voltage is needed. However, when such a booster circuit is used, with the reset transistor [which receives pressure up potential] with which a chip area increases, with which operation becomes complicated, which gains in power dissipation, the gate oxide of high pressure-proofing is needed.

[0009]

[Problem to be solved by the invention] When performing indispensable pouring discharge operation in a conventional amplification MOS type solid state image sensing device in order to avoid a residual image phenomenon as explained above, in order not to be influenced by pouring discharge in the cell of a non-choosing line, the potential of the detection node was low. For this reason, the margin of operation became narrow and undervoltage-ization of supply voltage was difficult.

[0010] In order to solve such fault, there was a method of using a booster circuit, but if it was in such a method, faults, such as enlargement of composition and increase of power dissipation, were caused.

[0011] Then, there is a place which this invention is made in view of the above, and is made into that purpose in offering the solid state image sensing device which raises the potential of the detection node at the time of reset, without using a booster circuit, extends a margin of operation, and can attain undervoltage-ization of supply voltage.

[0012]

[Means for solving problem] In order to attain the above-mentioned purpose, [invention according to claim 1] The light perceived according to the electrical change of the detection node which detects the signal electric charge obtained with the photo diode by photoelectric conversion is arranged in the shape of a procession by the cell read as electric information, and it [said detection node] In the solid state image sensing device which is connected to the drain wire which supplies reset voltage through a reset transistor at the time of reset, and it comes to connect with a reset control line with a common gate terminal of said reset transistor of the same line The transistor which carries out connection control of the vertical scanning circuit which carries out flow control of said reset transistor, and said reset control line, and separates said reset control line of a non-choosing line from said vertical scanning circuit at the time of reset of the cell of a selection line, It connects between said reset control line and said drain wire, and is characterized by having the coupling capacity which sets said reset control line of a non-choosing line as potential lower than the potential of said drain wire at the time of reset of said cell of a selection line.

[0013] Invention according to claim 2 inserts a separation transistor between said coupling capacity and said reset control line in a solid state image sensing device according to claim 1. Said separation transistor separates said reset control line and said coupling capacity of a selection line at the time of the drive of said reset transistor of the selection line by said vertical scanning circuit, and it is characterized by things.

[0014]

[Mode for carrying out the invention] The embodiment of this invention is hereafter explained using Drawings.

[0015] The figure showing the composition of the solid state image sensing device which requires drawing 1 for one embodiment of invention according to claim 1, and drawing 2 are the timing charts of pouring discharge operation in the equipment shown in drawing 1.

[0016] [the place by which it is characterized / of this embodiment] in drawing 1 Compared with composition, connection control of the vertical scanning circuit 11 and the reset control line 12 which carry out flow control of the reset transistor 3 is carried out conventionally which is shown in drawing 3. The connection control transistor 14 of the N channel which separates the reset control line 12 of a non-choosing line from the vertical scanning circuit 11 at the time of reset of the cell of a selection line, It connects between the reset control line 12 and the drain wire 7. When the coupling capacity 15 which sets the reset control line 12 of a non-choosing line as potential lower than the potential of the drain wire 7 at the time of pouring discharge operation of the cell of a selection line, and the vertical scanning circuit 11 drive the reset control line 12 of a selection line high-level, [the coupling capacity 15] Being in having added and constituted the control signal generation circuit 17 which generates the flow control signal of the separation transistor 16 of the N channel cut off from the reset control line 12, and each transistor 14 and 16, other composition is the same as the composition shown in drawing 3, and a same sign has the same function.

[0017] Next, in the above-mentioned composition, pouring discharge operation is explained with reference to the timing chart of drawing 2 of operation.

[0018] In the following explanation, a reference potential is set to 0V of a low level by this embodiment. Set high rank power supply potential to high-level 2.5V, and the threshold of the reset transistor 3 0.0V, The threshold of 0.0V and the selection transistor 6 is set [the threshold of a transfer transistor] to 0.5V for the threshold of 0.8V and the amplification transistor 5, the capacitance value of the coupling capacity 15 shall be set as 0.1pF, and the capacity of the reset control line 12 shall be about 0.4pF.

[0019] Before pouring discharge operation is performed, the drain wire 7 will serve as high-level power supply potential, the reset transistor 3, the transfer transistor 2, and the separation

transistor 16 of the cell of a selection line and a non-choosing line will be in non-switch-on, and the connection control transistor 14 has become switch-on.

[0020] In such a state, the separation transistor 16 is made into switch-on, and the terminal electrode side connected to the reset control line 12 of the coupling capacity 15 is charged the 0V [same] as the reset control line 12. Then, let the connection control transistor 14 of a non-choosing line be non-switch-on. Thereby, the reset control line 12 of a non-choosing line is separated from the vertical scanning circuit 11, and capacity coupling is carried out to the drain wire 7 by the coupling capacity 15.

[0021] Next, pouring discharge operation is performed as usual. First, the transfer transistor 2 of a selection line is made into switch-on, the reset transistor 3 is made into switch-on, and the drain wire 7 is continuously set to 0V. This pours an electron into the photo diode 1 of the cell of a selection line from the drain wire 7 to a low level. At this time, the potential of the reset control line 12 of a non-choosing line, i.e., the gate potential of the reset transistor 3, serves as a negative value with the coupling capacity 15. The electrical change of the drain wire 7 is 2.5V, and, specifically, the gate potential of the reset transistor 3 of a non-choosing line becomes about -0.5V from the capacity ratio of the reset control line 12 and the coupling capacity 15. Thereby, even if the threshold of the reset transistor 3 is 0V, the leakage current of the reset transistor 3 is set to about 1 pA, and the current leaked to the detection node 4 of a non-choosing line from the drain wire 7 can be disregarded. On the other hand, when the reset control line 12 of a non-choosing line is 0V like before, the current leaked to the detection node 4 of a non-choosing line serves as a 0.1microA grade from the drain wire 7, and not the value that can be disregarded very much but fault which was mentioned above will arise.

[0022] Next, the drain wire 7 is driven high-level and the electron poured into the photo-transistor 1 of the selection line is discharged to the drain wire 7. Then, make the reset transistor 3 into non-switch-on, and let the transfer transistor 2 be non-switch-on. Next, the connection control transistor 14 of a non-choosing line is made into switch-on, and the reset control line 12 of a non-choosing line is connected with the vertical scanning circuit 11. Then, the separation transistor 16 of a non-choosing line is made into non-switch-on, the capacity coupling of the reset control line 12 and the drain wire 7 is canceled, and pouring discharge operation of a selection line is completed.

[0023] Thus, in this embodiment, since the threshold of the reset transistor 3 is made to 0.0V, it becomes possible to operate equipment, without using a booster circuit with about [2.5V] supply voltage. Incidentally the signal read to the perpendicular signal line 8 can obtain saturation signal quantity with an equivalent to the case where supply voltage is made more than 5V amplitude of about 700mV. As a result, in the above-mentioned embodiment, the potential drop of the detection node 4 is suppressed without using a booster circuit, a margin of operation spreads, and low supply voltage operation is attained.

[0024] In addition, if the connection control transistor 14 and the separation transistor 16 are constituted from a P channel type transistor in the above-mentioned embodiment when transferring the reset control line 12 to about [-0.5V] negative potential Since changing reset control line potential by leak of the electron from the reset control line 12 to WERU (or substrate) is lost, it is advantageous. In addition, as a drive circuit of the connection control transistor 14 and the separation transistor 16, it is desirable to use a dynamic type circuit so that reset control line voltage can charge to supply voltage in this case.

[0025] Moreover, when it constitutes the connection control transistor 14 and the separation transistor 16 from an N channel type transistor, it is advantageous, if P WERU there is constituted in N WERU (or inside of Nsub), it dissociates with others and negative potential is applied.

[0026] Furthermore, in the above-mentioned embodiment, in order to acquire the operation effect mentioned above, you may exclude a transistor 16. Moreover, although individually prepared corresponding to each reset control line 12, you may make it form the coupling capacity 15 common to plurality or all the reset control lines 12. Furthermore, you may make it use the drain wire 7 of one of cells, although the drain wire 7 connected to the coupling capacity 15 has formed drain wire 7 with the another drain wire 7 of a cell, without forming another drain wire 7.

[0027]

[Effect of the Invention] Since the reset control line of the non-choosing line was set as potential lower than the potential of a drain wire at the time of reset of the cell of a selection line according to this invention to have explained above It can become possible to suppress the fall of the potential of a detection node, without using a booster circuit, a margin of operation can be extended, and low supply voltage operation can be attained.

[Brief Description of the Drawings]

[Drawing 1] It is the figure showing the composition of the solid state image sensing device concerning one embodiment of invention according to claim 1.

[Drawing 2] It is the figure showing the timing of the equipment shown in drawing 1 of operation.

[Drawing 3] It is the figure showing the composition of the conventional solid state image sensing device.

[Drawing 4] It is the figure showing the timing of the equipment shown in drawing 3 of operation.

[Explanations of letters or numerals] 1 Photo Diode 2 Transfer Transistor 3 Reset transistor 4 The detection node 5 Amplification transistor 6 The selection transistor 7 Drain wire 8 Perpendicular signal line 9 Level read-out circuit 10 Output amplifier 11 Vertical scanning circuit 12 Reset control line 13 Drain drive circuit 14 Connection control transistor 15 Coupling capacity 16 Separation transistor 17 Control signal generation circuit

[Translation done.]